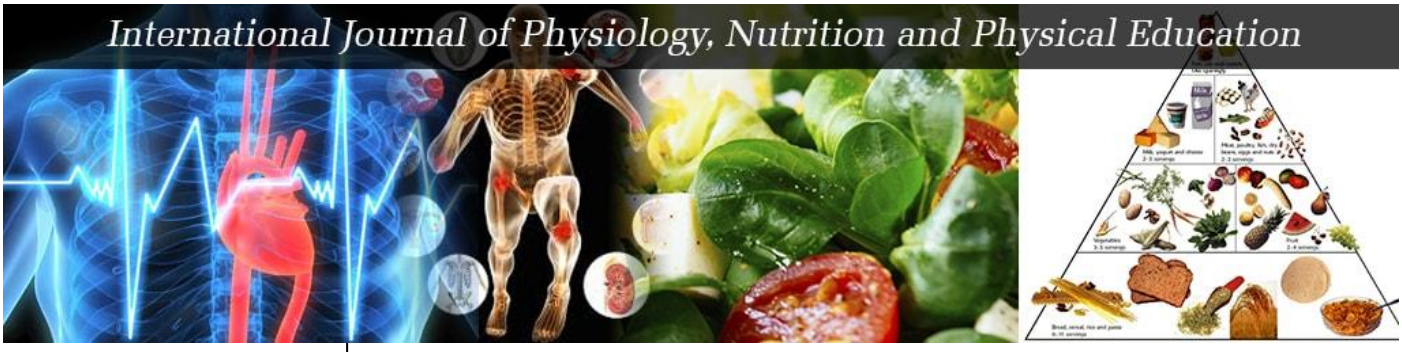

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Nutritional composition of a food product developed with combination of pulse and cereal family

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Abstract
Product development is defined as the modification of any existing product or formulation of an entirely new product. The newly developed product would be unique in its characteristics. It should be readily acceptable by the public or customers. It should be within affordable budget instead of being too costly. It should also have nutritional importance. Organoleptic properties are the aspects of food, water or other substances that an individual experiences through the sensory organs like tongue, eyes, nose and fingers which include taste, sight, smell and touch Five variations were made out of which the best product which was selected by majority of the subjects doing sensory evaluation of the product has the following nutritional composition per 100gm: Total Calories -449.96, Carbohydrates 44.43g, proteins 6.8g, fat 24.2g, sugar 1.13g and 1.48 iron content. The combination having soybean 50.3%, flaked rice 50 %, dates 23.25%. Curd 23.25%, butter 23.25% and cocoa powder 3.48% resulted in highest scores for colour, taste, firmness and over all acceptability. This paper shows the nutritional value of the developed food product after all major testings.

Keywords: Nutritional composition, cereal family

Introduction
Soybean (*Glycine max*); Soy flour consists of 50% protein, 5% fibre, it has higher levels of thiamine, riboflavin, phosphorus, calcium and iron than wheat flour. It does not contain gluten. Baking foods with soy flour gives it tenderness, moistness, a rich colour and a fine texture. Soy products are also used as low cost substitutes in meat and poultry products. Roasted and grounded soybeans can be used as a caffeine free substitute for coffee. After the soybeans are roasted and ground, they look similar to regular coffee beans or can be used as a powder similar to instant coffee, with aroma and flavour of roasted soybean. Soy contains isoflavones like genistein and diadzein, and glycitein. Glycitein is a phytoestrogen with weak estrogenic activity. Soybeans contain a high levels of phytic acid, which has many effects including acting as an antioxidant, and a chelating agent. The beneficial claims for phytic acid include reducing cancer, minimizing diabetes, and reducing inflammation. According to the American Cancer Society, studies in humans have not shown harm from eating soy foods Soybean is one of the leading crop commodities produced, traded and utilized globally. It is predominantly used as it is a source of high protein extracted from plants (Tiwari, 2017) [18].
Limbachiya and Amin (2015) [10] have developed multigrain muffin. They used soybean, ragi and Rice flakes flour for developing multigrain muffin with various processed techniques like soaking and germination, Drying techniques (sundry, roasting and oven dry). Fresh vegetable soybean is delicious and nutritious, and is an excellent source of protein (35 % to 38 % protein, dry weight basis) which helped to alleviate protein malnutrition in Jharkhand, particularly among children. Vegetable soybean fits in with local farming systems, is liked by consumers, and accepted in local diets (Ravishankar *et al*., 2016) [12]. Gluten free muffins were made out of rice flour, corn starch and soy flour (Man *et al*., 2014) [2]. Soybeans contain 40% high quality proteins with excellent digestibility. It has lysine which is not present in cereal, hence addition of soy flour improve the quantity and quality of protein content of the food product (muffin) and hence has the potential to combat against PEM (protein energy malnutrition (Man *et al*., 2014) [2]. Soymilk, is rich in a class of phytochemicals called isoflavones.

The most commonly occurring isoflavones in soy, diadzein, genistein, and glycitein have been found to display potent antioxidant effects such as the prevention of LDL oxidation. Soybean is a rich source of vegetable protein, complex carbohydrates, polyunsaturated fat, soluble fibers, and phytoestrogens (isoflavones) that may be beneficial in the prevention of diabetes. *In vitro* studies suggest that isoflavones have antidiabetic properties such as the inhibition of the intestinal brush border uptake of glucose. Animal studies have indicated that soy protein or isoflavones improve glycaemic control, lower insulin requirement. Several observational studies have also suggested that soy intake was associated with improved glycaemic control or lowered risk of diabetes. A recently published cross-sectional study reported that a higher intake of soy products decreased risk of type 2 diabetes in overweight Japanese women. Two therapeutic foods Diet I and Diet II were developed utilizing low glycaemic index food stuffs. The food stuffs used were rajma, horse gram dhal, green gram dhal, soybean, other pulses and leafy vegetables. Diet I was prepared using flours of horse gram dhal, Bengal gram dhal, jowar, wheat, cucumber and coriander leaves. Diet II was made using green gram dhal flour, rajmah flour, soybean flour, coriander leaves and onion. The developed recipes were evaluated for their acceptability and nutrient content was analysed. The clinical implication of these recipes were assessed on 30 normal female subjects belonging to age group of 20-30 years. Diet I and Diet II recorded almost same scores for acceptability. The glycaemic index of Diet I and Diet II was 37.06 +12.40 and 31.46 + 8, respectively (Khan *et al*, 2009) [9]. Hence diet II containing soybean shows lesser glycaemic index. Gluten free muffins were made out of rice flour, corn starch and soy flour (Man *et al*., 2014) [2]. Soybeans contain 40% high quality proteins with excellent digestibility. It has lysine which is not present in cereal, hence addition of soy flour improve the quantity and quality of protein content of the food product (muffin) and hence has the potential to combat against PEM (protein energy malnutrition (Man *et al*., 2014) [2]. Soybean is predominantly used as it is a source of high protein extracted from plant (Tiwari, 2017) [18]. The FDA says 25g of soy protein intake per day can reduce coronary heart disease. The UK Joint Health Claims Initiative (JHCL) re confirmed the assertion with a similar claim in 2002 (Udofia *et al*., 2013) [21].

Bolla (2015) [4] stated the various health benefits of soybean consumption and the usage of Soy for lowering high cholesterol, high BP, and curing type 2 diabetes mellitus, asthma, osteoporosis and different types of cancer. Soy based foods are rich in a particular compound known as "isoflavones", whose structure resemble hormone estrogen receptors known as phytoestrogens. Consumption of these isoflavones prove to be beneficial for diseases like cancer, CVD, osteoporosis and menopausal symptoms. Hence soy proteins are gaining importance in the daily diet of today's world. Soy is used for high cholesterol, high BP and preventing diseases of heart and blood vessels, type 2 diabetes, asthma, lung function and all types of cancer, slowing the progression of kidney disease and bone disease.

Gandhi (2009) stated the quality and importance of different types of soy foods and soy products like soy biscuits, soy breads, soy protein isolates, and soy flour and soy milk. Tofu, soy milk and soy nuts are derived from large seeded soybeans. Soy protein isolates are highly desirable for those who have high protein demands in the body due to growth in children, famine and chronic diseases like tuberculosis, HIV and AIDS. Soy biscuits which are made have a shelf life of about 6 months. They can be consumed with tea or coffee. Soy bread is also available which has a shelf life of about 6 days at normal temperature. Both soy biscuits and soy bread should be packed in polythene bags. Soy milk flavoured or plain can be taken by all and even by lactose intolerant patients can consume it. Shelf life of soy milk in tetra packs is 6 months and few weeks under refrigerated conditions. Soy flour may be full fat soy flour or medium fat soy flour. Its shelf life is about 1 month and it is sealed in polythene packets and need to be used up within 1 month of opening the packet. Gandhi developed HACCP protocols for product safety and better quality production of full fat soy flour.

Rice Flakes: Since rice is the common and staple food item of Asian countries various ready to eat rice products are made either at home scale or at small scale industry levels. But all these depend upon the various techniques used for harvesting, threshing, drying, handling, conveying, storage and aeration of the paddy and its by-products. Just after harvesting the paddy it cannot be directly eaten by humans due to the presence of non-edible covering on the rice. The outer protective layer, the bran part which is rich in proteins, vitamins and minerals are removed during milling and polishing. They are used in the preparation of rice bran oil. The rice which we eat is basically the endosperm part of the paddy which is made up of starch and protein. Rice is available in brown rice form or in white rice (polished rice) form or parboiled rice. Flaked rice, puffed or expanded rice and popped rice are the vital pre-cooked rice products available. Paddy was parboiled and puffed by sand roasting and flaked by edge runner and roller flaker and their variations in their physicochemical properties were studied (Chitra and Singh, 2010) [3]. Flaked rice is obtained by soaking and then roasting and in this process starch gets gelatinized and are converted to resistant starch which act as dietary fibres and lowers cholesterol and glycaemic index (Kumar and Prasad, 2017) [6]. The rice flakes which have been flattened, are light and oval in shape and are commonly known as "chura" or flaked rice. When these flakes of rice are added to any hot or cold liquids, they absorb the liquid part, whether it is water, milk or any other liquid and hence they swell up. These flakes are almost about four times thicker than the normal rice grains. Cereal flakes are the cheapest source of energy and protein in human diet. The word "cereal" has been derived from the Roman word "ceres", which is name of Roman Goddess of harvest and agriculture. Rice flakes are obtained from paddy. It is eaten either fried in oil or soaked in milk or curd or yoghurt (Nazni and Bhuvaneswari, 2011) [8]. Flaked rice is obtained after soaking, roasting and some roasting medium like sand. Sometimes direct pan is used for roasting and sometimes common salt is used as heat transfer medium. In this roasting process starch granules are gelatinized and a part of it gets retrograded. This finally gets converted into resistant starch. Starch digestibility after dry heat parboiling and flaking followed by roasting reduces the glycaemic index. It has been seen that flaked rice and parboiled rice have lower GI than raw rice. Roasted flaked rice also increase the dietary fibres in it which is one more criteria which contributes to the low GI. This resistance starch also prevent the risk of onset of colon cancer by maintaining gut health acting as prebiotic (Kumar and Prasad, 2017) [6] Pregelatinized rice flakes have been produced specifically for brewing, developing characteristics necessary for easy and efficient use in a brew house. The process of

gelatinizing makes the starches readily soluble and digestible by the naturally occurring enzymes in barley malt. This allows the flakes to be incorporated directly into the mash with the other grains. They hydrate and disintegrate quickly as the flakes have a larger surface area and are precooked. Filtration time will be normal. There is no need to mill rice flakes. However they can be put through the mills if that is the easiest means of adding them to the mash. Rice flakes are popularly known as "beaten rice". 100gm of flaked rice gives 364kcal of energy, 20mg of calcium, and 20mg of iron. It is light and easily digested and is a rich source of vitamin B. Hence it is consumed very broadly all over India especially by elderly and aged persons in their night meals. As it is easily chewable when soaked in any liquid and it is easily digestible it is a common diet for aged persons who have denture problem or indigestion problems especially during night times. The production level of rice flakes is not known in exact figures. But it has been expected that 10% of total rice production is utilized for flaked rice and popped rice production. But of course the states which have flaked rice as their breakfast cereal they produce more flaked rice and that too have large industries there. Hubli, Bhadravati, Udipi and Belgam are rice flakes production centres in Karnataka. Gujrat, Madhya Pradesh and Orissa are other major producers of flaked rice. In other states rice flake production is only at cottage levels. Various processes involved in the production of flaked rice are cold or hot soaking, roasting, flaking, sieving and packing. Generally freshly harvested paddy is preferred for flaked rice production as it gives more whiteness. At the cottage level daily production of flaked rice is about 50 – 300kg / day.

Dates (*Phoenix dactylifera*) are one of the members of the palm family Arecaceae, or Palmae. The date palm (*Phoenix dactylifera* L.) is one of oldest cultivated plants of human kind and used as food for 6000 years. It is the main crop in Egypt, Saudi Arabia, and Middle Eastern countries. It is thought that the native origin of dates is around the Persian Gulf, and has been cultivated from Mesopotamia to prehistoric Egypt as early as 4000 BCE. Due to the old historical prospective of date, the exact date of origin is very difficult to identify (Rahmani *et al*., 2014) [13].

Diabetes mellitus is a silent killer disease which is nowadays getting recognized as one of the most vital and fastest spreading health problems in almost all developing countries and as well as in developed countries. It is affecting all body parts or body organs gradually if it is not kept under control, hence it can be designated as "mother of all illnesses". Though in some instances diabetes cannot be completely cured but atleast by diet management it can be kept under control. It can be controlled by various aids like using varied combination diets and exercise and various groups of drugs. One of the major consideration done in the diet planning of diabetic patient is the use of low glycaemic index food stuffs so that the sugar level can be kept under control. Glycaemic index (GI) indicates the extent of rise in blood glucose level in response to a food in comparison with the response to an equivalent amount of glucose. It can be defined as a rating system by which it can be evaluated as how different foodstuffs affect the blood sugar levels in the body. Nowadays this rating system is extensively used in selecting the appropriate foodstuffs having low GI and create diets which always aim in controlling diabetes and manage both diabetes and obesity (Khan *et al*., 2009) [9].

Research Gap

Bakery is a traditional activity and occupies a vital position in the food processing industry. About 1.3 million tonnes of the various bakery products industry in India is under organised sector out of total 3 million tonnes and the rest comes under unorganised and small scale local manufacturers of bakery products. Though the demand for the bakery products in India has been continuously increasing lack of certain nutritive awareness is still prevailing in the baking industry. The Indian bakery industry consists of some of the large food categories like breads, biscuits, cakes, pastries, muffins, doughnuts, cookies, cupcakes, brownies and muffins. Though bakers have nowadays started experimenting and developing various bakery products with certain new ingredients like gluten free products, diabetic products but still the ingredients which are normally used in muffins are wheat flour or so called maida, egg, butter and sugar. All these ingredients are not nutritionally very rich though taste wise the products are very top quality. My research work is to focus on the fact to develop muffins with ingredients which will not contain any trans-fat (harmful for CVD patients), have high quality proteins and fibre content which are beneficial for malnourished children, and lowering cholesterol levels in the blood. As the ingredients which I am using for my product development has low glycaemic index which will allow even diabetic patients to consume my product. Till now no such nutritionally sound muffin has been produced by any baking industries. My product is without wheat flour (maida) and without sugar.

Muffin is an individually baked product. As baking is a method of cooking which is using dry heat instead of water, it do not cause the loss of some minerals and some water soluble vitamins. Muffin is similar to cup cakes. It is less sweet and lacks icing. Hence more nutritious than cakes and pastries. Muffins are usually served in breakfast whereas cakes and pastries are considered as dessert items. The objective of my product development is to develop a highly nutritious protein rich, fibre rich and low glycaemic index product which can be consumed by diabetic patients. Soy chura dates muffin can be considered as a good source of protein in vegan diet. Soybean rich in lysine (which is not present in cereals) gives a good quality and quantity of proteins to the newly developed product (Man *et al*, 2014) [2]. In this product sugar will be substituted with dried dates, whose carbohydrate content is 75g/100g (NIN) as compared to sugar whose carbohydrate content is 99g/100g (NIN).Dried dates having Glycaemic index of 42 is considered as a better substitute of sugar for diabetic patients.

Materials and Methods

Materials required are soy granules, Bengal gram or channa dal, flaked rice or chura, dates or khajur, baking powder, curd or dahi, cocoa powder, vanilla essence and butter. All of the materials were bought from the market. The equipment required were mixer and grinder, gas burner, hand mixer, hand blender, baking oven and aluminium muffin mould.

Steps involved in making the product

1. Butter is melted in a microwave oven and kept aside
2. Curd is whipped and vanilla essence added to it and kept aside
3. Soybean granules, Bengal gram dal and flaked rice are separately grinded in a mixer and mixed al together.
4. Cocoa powder and baking powder are added to the grinded materials and kept separately

5. In a mixer grinder melted butter and whipped curd are blended at first
6. To this blended mixture the pre-soaked dates in a mashed form are added and again blended until a smooth batter is obtained
7. To this smooth batter the grinded powder mixture kept aside is slowly added and again blended thoroughly until a foamy smooth batter is obtained
8. Muffins cups made of aluminium are greased with Sundrop oil and the batter is distributed evenly in all the muffin cups.
9. The oven is pre heated to 180 degree C and then the cups with the batter are placed on a rack kept inside the oven
10. Bake for 20 – 30 minutes until they are fully baked.

Fig 1: Picture of Baked Muffins

Table 1: Nutritional Composition of The developed Muffins

Parameters	Sample B
Fat	27.2±0.36
Protein	6.8±0.45
Total carbohydrates	44.4±0.36
Sugar	19.13±0.35
Energy	449.96±0.47
Moisture	26.6±0.40
Ash	3.4±0.36
Iron	1.48±0.43

Mean ± S.D. in a row differ significantly (p<0.05) (n=3)

The results of chemical composition of accepted muffin having 50% of Soyabean flour are summarized in the Table 2. Moisture content of selected blend with highest acceptability containing 50% of Soyabean flour and 50% Rice flake flour was 26.7%. With the increase in the Soyabean flour proportion in the blends, there was increase in the moisture content. Ash content of the selected blend was 3.4%. It was observed that with the decrease in the amount of Soyabean flour, the ash content of the blends increased.

The protein content was 6.8g/100g and the value decreased significantly with decreasing the levels of Soyabean flour to corn flour. Total carbohydrate content of the selected blend was 44.7/100g and the value decreased significantly with decreased levels of Soyabean flour. The carbohydrate contents were found to be highest for the blends containing 50% Soyabean flour with respect to all proximate composition parameters (protein, ash, moisture and carbohydrate) determined in this study. Carbohydrate supplies quick source of metabolizable energy and assists in fat metabolism. Sugar content of the selected blend was 19.1/100g. Energy value of selected blend varied between was 449.9 Kcal/100 g. Fat content of selected blend was 27.2/100g. Iron content in selected blend was 1.49mg/100g. Highest iron content was observed in case of muffin containing 50% Soyabean flour.

Cooking properties of Muffins

Cooking properties play an important role in indicating the quality of muffins. Different cooking properties include: cooking time and cooked weight.

Cooking time

Time required for the preparation of muffin is considered as the cooking time. The cooking time for the different muffin samples ranged between 40 to 45 minutes. The results showed that cooking time decreased with increase in level of corn flour substitution. Cooking time was maximum for sample with the maximum Soyabean flour content (70%) that is 45 minutes and minimum for muffin containing Soyabean flour (40%) that is 40 minutes.

Cooked Weight

As the percentage of Soyabean flour in blends decreased, the cooked weight significantly decreased. The cooked weight was maximum for muffin made from 50% Soyabean flour (***35***.5 g) as shown in Table 2.

Table 2: Cooking properties of Muffins

Cooking Properties	Sample B (50% Soyabean Flour)
Cooking Time (in minutes)	43±1.58
Cooking Weight in gms	35.44±0.104

Mean ± S.D. in a row differ significantly (p<0.05) (n=3)

Colour characteristics of the Muffin

The colour of the food products is the first attribute that affects the decision of consumer for purchasing or consuming any food products. Different muffin samples containing different percentage of Soyabean flour are represented in Figure.no.1.

Conclusion

Chemical composition, vitamin and mineral analysis of Soyabean flour and Rice flake flour were evaluated for the production of muffins. Soyabean flour varied significantly (P<0.05) from Rice flake flour with respect to its highest carbohydrate content (44.3%), protein (6.5%) and iron content (1.04%). The studies were undertaken to see the effect of deduction of different levels of Soyabean flour (40-70%) on muffin making properties of Rice flakes flour. The cooking properties of muffins such as cooking-time and cooked-weight were also determined for different Soyabean flour and Rice flakes flour composite blends. The results revealed that cooking time and cooked weight increased with increase in level of Soyabean flour substitution. Colour of the muffin was affected by Soyabean flour deduction. With the decrease in the Soyabean flour proportion in the blends, there was decrease in protein and iron content. The sensory panelists rated the muffin prepared from 50% level of Soyabean flour addition to corn flour with highest acceptability scores. Incorporation of Soyabean flour upto 50% resulted in muffin of comparable in most quality parameters considered (nutritional, vitamin, mineral analysis and sensory parameters). This shows that incorporation of Soyabean flour in the process of muffin making could enhance the mineral and vitamin intake. The results of this study are good indicators of the possibilities of better utilization of Soyabean flour through developing variety new food products. Thus, the muffin prepared from Soyabean flour and Rice flakes flour are gluten free and are rich in minerals calcium, iron, zinc and phosphorus and also contains moderate amounts of fibre and

can be a good option for people having diarrhea, dermitits. Given its good fibre content, its ability to provide many B-complex vitamins including vitamins B1, B5 and folic acid, and its notable protein content it is a food that would be expected to provide blood sugar benefits. They are good nutritive source to improve overall nutrient status and to help provide outstanding nutrient richness in the diet. Being a rich source of folic acid these muffins are particularly beneficial for pregnant women. The antiatherogenic effect on cholesterol levels helps in protecting against cardiovascular diseases also the anti-diabetic effect would help patients of Diabetes Mellitus.

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